

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A system, comprising:

a transmitter configured to transmit a signal, the transmitter including

a 2^P -state quadrature amplitude modulation (QAM) submodulator configured to receive an original data stream and to produce an encoded data stream of symbols, wherein P is a length of sequence of tones,

a M-ary frequency shift keying modulator configured to receive the encoded data stream and to modulate each symbol as a length four sequence of tones, each tone of the length four sequence having a frequency corresponding to one of M frequencies, wherein M is a number of frequencies, and each unique length four sequence of tones corresponding to a respective unique symbol, and

a mechanism for transmitting each of the length four ~~sequences~~ sequence of tones as the signal; and

a receiver configured to receive the signal and to incoherently demodulate the signal to recover the original data stream, the receiver including

a M-ary frequency shift keying demodulator configured to receive the signal and to demodulate the signal to produce a demodulated sequence of tones, each tone corresponding to one of the M frequencies, and

a 2^P -state quadrature amplitude modulation (QAM) subdemodulator configured to receive the demodulated sequence of tones, to correlate the demodulated sequence of tones into the encoded data stream of symbols, and to decode the encoded data stream of symbols to produce the original data stream.

Claim 2 (Previously Presented): The system of Claim 1, wherein:

M is equal to $(2^{P/2+1}-1)$.

Claim 3 (Previously Presented): The system of Claim 1, wherein:

M is selected such that each unique length four sequence of tones has zero frequency bias such that the modulator has no DC frequency response.

Claim 4 (Original): The system of Claim 1, wherein:

the M-ary frequency shift keying demodulator is configured to have a peak deviation such that the system has a bit error rate for a particular carrier to noise ratio at the receiver, the bit error rate being equal to another bit error rate corresponding to the carrier to noise ratio for a coherent 2^P -level frequency shift keying system.

Claim 5 (Previously Presented): The system of Claim 1, wherein:

the 2^P -state quadrature amplitude modulation (QAM) subdemodulator comprises a correlator having no DC response.

Claim 6 (Currently Amended): The system of Claim 1, wherein:

M and P are selected such that ~~the~~ a DC component is removed from the encoded data stream of symbols without reducing a bit rate of the original data stream.

Claim 7 (Previously Presented): The system of Claim 1, wherein:

the demodulated sequence of tones produced by the M-ary frequency shift keying demodulator comprises a modulation domain signal, and
the receiver further includes a trip detection mechanism including

a 2^P -state quadrature amplitude modulation (QAM) trip correlator configured to receive the modulation domain signal and produce an in-phase (I) data signal and a quadrature (Q) data signal, the I data signal and the Q data signal having a symbol rate;

an averager configured to receive the I data signal and the Q data signal and to produce an averaged I data signal and an averaged Q data signal;

a Cartesian-to-polar converter configured to receive the averaged I data signal and the averaged Q data signal and to produce a first signal containing magnitude information and a second signal containing angle information;

a first delay configured to receive the first signal containing magnitude information and to produce a delayed first signal, the delayed first signal being delayed by one symbol relative to the first signal;

a second delay configured to receive the second signal containing angle information and to produce a delayed second signal, the delayed second signal being delayed by one symbol relative to the second signal;

a first comparator configured to receive the first signal and the delayed first signal and to produce a first output signal, the first output signal having

a true value if an absolute value of a difference between the first signal and the delayed first signal is less than a first predetermined threshold, and
a false value otherwise;

a second comparator configured to receive the second signal and the delayed second signal and to produce a second output signal, the second output signal having

a true value if an absolute value of a difference between the second signal and the delayed second signal is less than a second predetermined threshold, and

a false value otherwise; and

an AND gate configured to receive the first output signal and the second output signal and to produce a third output signal containing trip detection information, the third output signal having

a true value indicating a positive trip detection if both the first output signal and the second output signal have a true value, and

a false value indicating a false trip detection otherwise.

Claim 8 (Currently Amended): The system of Claim [[1]] 7, wherein the receiver further includes:

a synchronization mechanism configured to orient a quadrature amplitude modulation (QAM) constellation and frame symbols of a data stream for subsequent demodulation when the trip detection information has a true value,

wherein the quadrature amplitude modulation (QAM) constellation is gray encoded to enable 1-bit error correction.

Claim 9 (Currently Amended): A cellular one-way communication network, comprising:

a plurality of first nodes configured to transmit a first data packet on a predetermined frequency;

a first base station configured to receive signals transmitted on the predetermined frequency;

a second base station locationally dispersed from the first base station and configured to receive signals transmitted on the predetermined frequency; and

a data concentrator, wherein

the plurality of first nodes are configured to transmit using a duty cycle of less than 0.1% and to transmit a unique identification parameter,

the first base station and the second base station are arranged in a configuration such that a first coverage area of the first base station at least partially overlaps a second coverage area of the second base station,

the first base station and the second base station each ~~receive~~ receives the first data packet transmitted by at least one of the plurality of first nodes, and

the data concentrator is configured to collect the first data packet received by the first base station and the first data packet received by the second base station.

Claim 10 (Currently Amended): The network of Claim 9, wherein each of the plurality of first nodes is a transceiver, comprising:

a first mechanism configured to transmit a first signal including an encoded and modulated first original data stream, the first mechanism having

a 2^P -state quadrature amplitude modulation (QAM) submodulator configured to receive an original data stream and to produce an encoded data stream of symbols, wherein P is a length of sequence of tones,

a M-ary frequency shift keying modulator configured to receive the encoded data stream and to modulate each symbol as a length four sequence of tones, each tone of the length four sequence having a frequency corresponding to one of M frequencies, wherein M is a number of frequencies, and each unique length four sequence of tones corresponding to a respective unique symbol, and

a mechanism for transmitting each of the length four ~~sequences~~ sequence of tones as the first signal; and

a second mechanism configured to receive a second signal including an encoded and modulated second original data stream, the second mechanism being configured to incoherently demodulate the second signal and having

a M-ary frequency shift keying demodulator configured to receive the second signal and to demodulate the second signal to produce a demodulated sequence of tones, each tone corresponding to one of the M frequencies, and

a 2^P -state quadrature amplitude modulation (QAM) subdemodulator configured to receive the demodulated sequence of tones, to correlate the demodulated sequence of tones into an encoded data stream of symbols, and to decode the encoded data stream of symbols to produce the second original data stream.

Claim 11 (Currently Amended): The network of Claim 9, wherein:

the plurality of first nodes are configured to transmit a the first data packet on a predetermined frequency using a transmitter configured to transmit a frequency shift keying modulated signal having an imprecise modulation deviation, the modulated signal including a short leader including a constant repeating symbol pattern, and

the first and second base stations are each configured to receive signals transmitted on the predetermined frequency using a receiver, including

a signal demodulator configured to convert the modulated signal to a modulation domain signal, and

a post detection theta-r trip detection mechanism configured to detect an acquisition of the short leader included in the modulation domain signal.

Claim 12 (Currently Amended): The network of Claim 9, wherein:

the plurality of first nodes are further configured to transmit at a plurality of preset frequencies, the predetermined frequency being one of the plurality of preset frequencies,
the first base station and the second base station are further configured to receive at the plurality of preset frequencies, and
each of the preset frequencies is a narrowband frequency channel ~~channels~~.

Claim 13 (Original): The network of Claim 9, wherein:

the plurality of first nodes do not include a power control mechanism configured to adjust a transmission output power in response to a near/far problem.

Claim 14 (Currently Amended): The network of Claim 9, further comprising:

a second node configured to transmit a second data packet on a second predetermined frequency, wherein

the first base station and the second base station are further configured to receive signals on the second predetermined frequency,

the first base station and the second base station each ~~receive~~ receives the second data packet transmitted by the second node,

the predetermined frequency and the second predetermined frequency are on adjacent channels,

a first received signal level at the first base station is uncorrelated with a second received signal level at the second base station,

the first base station receives the first data packet on the predetermined frequency at a first signal level and the second data packet on the second predetermined frequency at a ~~first~~ second signal level, the first signal level is higher than the second signal level,

the second base station receives the first data packet on the predetermined frequency at a third signal level and the second data packet on the second predetermined frequency at a fourth signal level, the third signal level is higher than the fourth signal level, and

the data concentrator is further configured to overcome the effects of channel roll off to adjacent channels by collecting the first data packet successfully received by the first base station and the second data packet successfully received by the second base station.

Claim 15 (Currently Amended): The network of Claim 9, wherein:

the first base station and the second base station are further configured to abort receiving signals ~~received with~~ having poor signal quality.

Claim 16 (Original): The network of Claim 9, wherein:

the first data packet includes a message identification field,
the plurality of first nodes are further configured to re-transmit the first data packet at least one time after a delay between transmissions, and
the data concentrator is further configured to collect a first copy of the first data packet from the first base station and a second copy of the first data packet from the first base station and to eliminate one of the first copy of the first data packet and the second copy of the first data packet as a redundant message based on a value of the message identification field.

Claim 17 (Currently Amended): The network of Claim 9, wherein:

the plurality of first nodes are further configured to redundantly retransmit the first data packet M times at a time interval of $1/\lambda$, wherein M is a number of frequencies and λ is an inverse of a time between transmissions;

each of the plurality of first nodes is one of N nodes, each of the N nodes being within a coverage area of a base station;

the first base station and the second base station are two of B base stations, the B base stations having a coverage area such that each of the B base stations ~~receive~~ receives the first data packet from at least one of the plurality of first nodes, and

a system probability of successful reception of the first data packet satisfies an ALOHA equation

$$P_s = 1 - [1 - e^{-\lambda NT}]^{MB}, \text{ where}$$

P_s is a probability of a successful reception at one of the B base stations, and T is a time duration of the first data packet.

Claim 18 (Currently Amended): The network of Claim 9, wherein:

the plurality of first nodes are further configured to enter a low power mode after transmitting the first data packet and until another data packet is transmitted,

the plurality of first nodes are further configured to leave the low power mode in response to at least one of a timer and an external event, and

the plurality of first nodes are further configured to respond to the at least one of a the timer and ~~an~~ the external event by

enabling a frequency determining crystal,

placing a microprocessor into a run state,

causing the microprocessor to format a data packet,

transmitting a synchronization leader,

transmitting a plurality of identification bits corresponding to at least one of

the plurality of first nodes,

transmitting a plurality of data bits,

transmitting a plurality of error detection bits, and
causing the low power state mode to be re-entered.

Claim 19 (Currently Amended): The network of Claim 9, wherein
the plurality of first nodes are further configured to transmit a message including a
sequence of data packets on the predetermined frequency, each of the data packets including
a sequence number identifier corresponding to a position of the data packet in the sequence,
the first base station and the second base station are further configured to receive the
message transmitted by at least one of the plurality of first nodes,
the data concentrator is further configured to collect the message received by the first
base station and the second base station,
each of the data ~~packet~~ packets further includes a historic data field including data
from an earlier transmission of at least one of the plurality of first nodes, and
the data concentrator is further configured to determine when a data packet has not
been received based on the sequence number identifier and to collect missing data from the
historic data field of a subsequently collected data packet.

Claim 20 (Original): The network of Claim 9, wherein:
the plurality of first nodes are further configured to transmit at one of
a normal mode having a normal baud at the predetermined frequency, and
a boost mode having a boost baud at a boost frequency,
the boost baud being lower than the normal baud, and the boost frequency being
different than the predetermined frequency.

Claim 21 (Currently Amended): The network of Claim 9, further configured to increase having a method for increasing channel capacity, comprising by including:

transmitting a transmitter configured to transmit at a the predetermined frequency, by from at least one of the plurality of first nodes within a coverage area of at least one of the first base station and the second base station, a message of length T, M times at an interval of $1/\lambda$, wherein M is a number of frequencies and λ is an inverse of a time between transmissions;

receiving, by a receiver of at least one of the first base station and the second base station configured to receive[[],] the message with a probability of success satisfying the ALOHA equation

$$P_s = 1 - [1 - e^{-(2\lambda NT/P)}]^M, \text{ where}$$

P_s is a probability of a successful reception by at least one of the first base station and the second base station, and

P is a ratio of a signal bandwidth to an available system bandwidth, wherein the predetermined frequency is one of a plurality of adjacent frequency channels, and frequency guard bands between the plurality of adjacent frequency channels are not allocated.

Claim 22 (Original): The network of Claim 9, further comprising:

a bi-directional bridge configured to connect the network to another network, wherein the bi-directional bridge is further configured to at least one of

re-transmit a first message received from the network to the another network immediately upon reception of the first message and

re-transmit a second message received from the another network to the network immediately upon reception of the second message.

Claim 23 (Currently Amended): The network of Claim 9, wherein:

the predetermined frequency is one of a plurality of narrowband frequency channels, and the first base station and the second base station each having a mechanism for evaluating the plurality of narrowband frequency channels and selecting an optimum channel of the plurality of narrowband frequency channels for use in detecting a signal, comprising:

a channel filter bank configured to receive an input signal and produce a channel bank having at least two channelized outputs, each of the at least two channelized outputs having a reduced bandwidth relative to the input signal and corresponding to a different center frequency;

a downconverter configured to downconvert the channel bank to baseband;

a magnitude determination mechanism configured to determine a magnitude for each of the at least two channelized outputs;

a selection mechanism configured to select one of the at least two channelized outputs having a largest magnitude as determined by the magnitude determination mechanism and to output an index corresponding to the selected one of the at least two channelized outputs;

an averaging mechanism configured to average the index output by the selection mechanism with at least one additional index subsequently output by the selection mechanism to produce an averaged channel index;

a rounding mechanism configured to round the averaged channel index to a nearest channel index and output a rounded channel index; and

a ~~multiplexing~~ selecting mechanism configured to pass one of the at least two channelized outputs as a passed channel based on the rounded channel index.

Claim 24 (Currently Amended): The network of Claim 9, wherein:

the predetermined frequency is one of a plurality of narrowband frequency channels, and the first base station and the second base station each having a mechanism for evaluating the plurality of narrowband frequency channels and selecting an optimum channel of the plurality of narrowband frequency channels for use in detecting a signal, comprising:

a channel filter bank configured to receive an input signal and produce a channel bank having at least three channelized outputs, each of the at least three channelized outputs having a reduced bandwidth relative to the input signal and corresponding to a different center frequency;

a downconverter configured to downconvert the channel bank to baseband;

a magnitude determination mechanism configured to determine a magnitude for each of the at least three channelized outputs;

a selection mechanism configured to select one of the at least three channelized outputs having a largest magnitude as determined by the magnitude determination mechanism and to output an index corresponding to the selected one of the at least three channelized outputs;

an averaging mechanism configured to average the index output by the selection mechanism with at least one additional index subsequently output by the selection mechanism to produce an averaged channel index;

a rounding mechanism configured to round the averaged channel index to a nearest channel index and output a rounded channel index;

a multi-channel ~~multiplexing~~ identifying mechanism configured to pass at least three of the at least three channelized outputs as at least three passed channels, the at least three passed channels being adjacent to one another and centered in frequency based on the rounded channel index;

a multi-channel FM demodulation mechanism configured to receive and FM demodulate each of the at least three passed channels and output at least three modulation domain channels corresponding to the at least three passed channels;

a multi-channel averaging mechanism configured to average the at least three modulation domain channels with at least one additional set of at least three modulation domain channels subsequently output by the multi-channel FM demodulation mechanism to produce at least three averaged modulation domain channels corresponding to the at least three modulation domain channels;

a second selection mechanism configured to select one of the at least three averaged modulation domain channels having a minimum frequency error and to output a second index corresponding to the selected one of the at least three averaged modulation domain outputs;

a ~~multiplexing~~ selecting mechanism configured to pass one of the at least three channelized outputs as a passed channel based on the second index, wherein

the passed channel is provided for at least one of signal detection and signal acquisition.

Claim 25 (Currently Amended): The network of Claim [[9]] 10, wherein:

the first base station and the second base station ~~receiver includes~~ each has a receiver that includes

a downconverter configured to convert ~~the~~ a received signal to an intermediate frequency signal,

a bandpass filter configured to have a center frequency equal to a frequency of the intermediate frequency signal, to receive the intermediate frequency signal and to bandpass filter the intermediate frequency signal, and to output a filtered intermediate frequency signal,

a gain configured to establish noise floor and signal sensitivity,
a FM demodulator configured to receive the filtered intermediate frequency signal and to output a modulation domain signal,
a digitizer configured to receive the modulation domain signal and to output a digitized modulation domain signal, and
a delay configured to receive the digitized modulation domain signal and output a delayed modulation domain signal based on an input control; and
the subdemodulator includes
a quadrature amplitude modulation (QAM) correlator configured to receive and translate the delayed modulation domain signal into a correlation quadrature output signal,
a theta-r trip determination mechanism configured to receive the correlation quadrature output signal and to output a trip indication signal during a leader portion of a received message,
a bit timing alignment and deviation determination mechanism configured to receive the trip indication signal and output the input control and at least one data decision threshold, and
a data demodulator configured to receive the correlation quadrature output signal, decode the received message, and output a decoded data stream corresponding to the an original data stream.

Claim 26 (Currently Amended): The network of Claim 25, wherein the quadrature amplitude modulation (QAM) correlator is further configured ~~for removing~~ to remove frequency uncertainty from a received signal, the quadrature amplitude modulation (QAM) correlator comprising:

~~FM demodulating the received signal using a~~ the FM demodulator configured to be sufficiently linear over a system frequency uncertainty;

~~the quadrature amplitude modulation (QAM) subdemodulating~~ subdemodulator configured to subdemodulate a modulation domain signal from the FM ~~demodulating step~~ demodulator using a quadrature amplitude modulation (QAM) subdemodulator configured to have no DC response.

Claim 27 (Original): The network of Claim 9, wherein:

the plurality of first nodes are further configured to be frequency agile such that the predetermined frequency comprises one of a plurality of frequencies,

at least one of the first base station and the second base station is further configured to receive each of the plurality of frequencies such that a number of nodes receivable by the at least one of the first base station and the second base station increases by a factor of πr^2 , and r is a communication range of the nodes.

Claim 28 (Original): The network of Claim 9, wherein:

the plurality of first nodes are configured to redundantly transmit a data payload by transmitting at least a portion of the data payload a plurality of times separated by a time interval.

Claim 29 (Original): The network of Claim 9, wherein:

the plurality of first nodes are configured to redundantly transmit a data payload by transmitting at least a portion of a previously transmitted data payload in the data payload.

Claim 30 (Original): The network of Claim 9, wherein:

the plurality of first nodes are configured to redundantly transmit a data payload by transmitting a plurality of at least a portion of previously transmitted data payloads in the data payload.

Claim 31 (Canceled).